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SEDIMENT TRANSPORT BY THE WHITE RIVER INTO MUD MOUNTAIN RESERVO--ETC(U)
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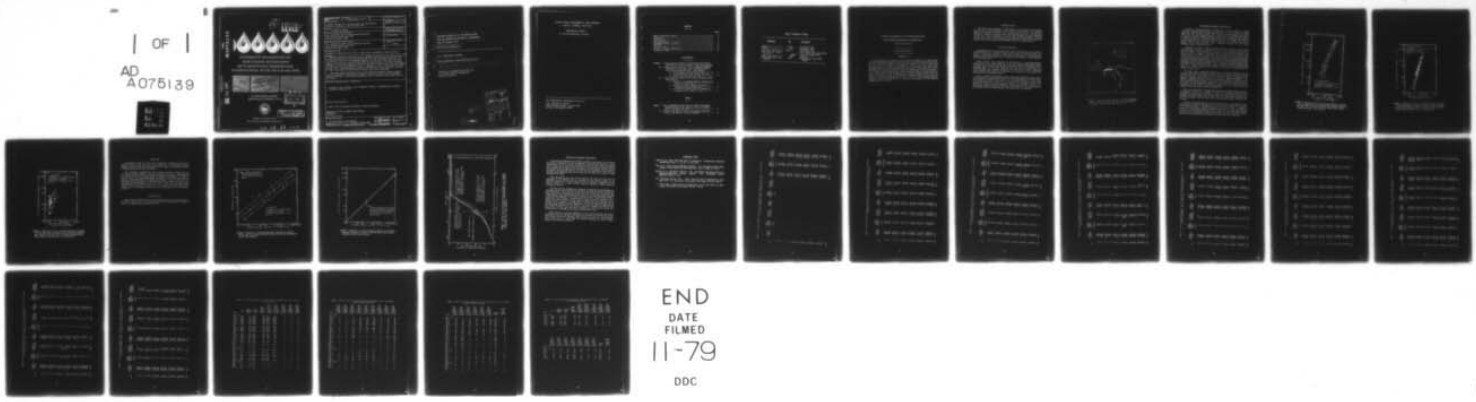

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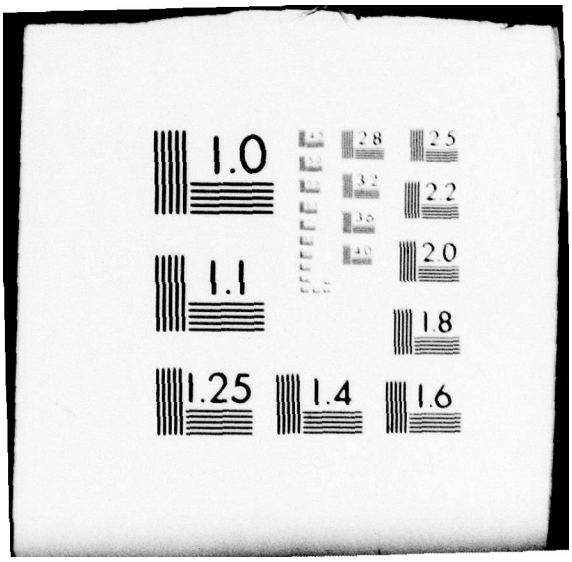
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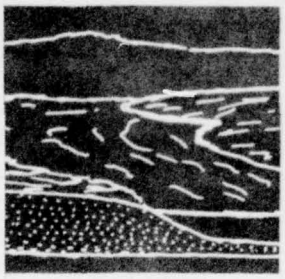
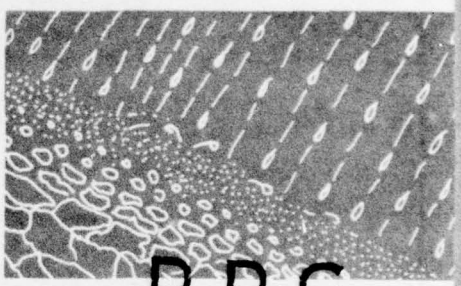
SEDIMENT TRANSPORT BY THE WHITE RIVER INTO MUD MOUNTAIN RESERVOIR, WASHINGTON, JUNE 1974-JUNE 1976





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16. Abstracts

This reconnaissance evaluation of the sediment transported by the White River into Mud Mountain Reservoir during the period June 1974-June 1976 showed that the river transported 430,000 tons of suspended sediment into the reservoir during the first year of the study and 1,400,000 tons during the second year. Daily mean suspended-sediment concentrations generally were less than 500 milligrams per liter; the highest recorded was 6,200 milligrams per liter, on December 1, 1975. A good relation exists between daily suspended-sediment discharge and mean daily water discharge, although no clear trend exists during period of glacial melt-water discharges.

Data from samples obtained by use of the Helley-Smith bedload sampler indicate that the bedload measured using the sampler is about 4 percent of the suspended-sediment discharge. The potential deposition was 750 acre-feet during the period of the study.

17. Key Words and Document Analysis. 17a. Descriptors

*Suspended load, *Particle size, *Sediment transport, *Sedimentation, Sediment discharge, Sediment load

17b. Identifiers/Open-Ended Terms

White River; Mud Mountain Reservoir; western Washington

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(10) By Leonard M. Nelson

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UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

For additional information write to:

U.S. Geological Survey
1201 Pacific Avenue - Suite 600
Tacoma, Washington 98402

CONTENTS

ILLUSTRATIONS

TABLES

METRIC CONVERSION FACTORS

Multiply	By	To obtain
Inches	25.40	millimeters (mm)
Miles	1.609	kilometers (km)
Acre-feet (acre-ft)	1233.	cubic meters (m^3)
Cubic feet per second (ft^3/s)	.02832	cubic meters per second (m^3/s)
		liters per second (L/s)
Tons (2,000 lbs)	.9072	tonnes (t)
Pounds per cubic feet (lb/ft^3)	16.02	kilograms per cubic meter (kg/m^3)

SEDIMENT TRANSPORT BY THE WHITE RIVER INTO MUD MOUNTAIN RESERVOIR, WASHINGTON, JUNE 1974-JUNE 1976

By Leonard M. Nelson

ABSTRACT

This reconnaissance evaluation of the sediment transport by the White River into the Mud Mountain Reservoir during the period June 1974-June 1976 showed that the river transported 430,000 tons of suspended sediment into the reservoir during the first year of the study and 1,400,000 tons in the second year. Daily mean suspended-sediment concentrations generally were less than 500 milligrams per liter; the highest daily mean concentration was 6,200 milligrams per liter on December 1, 1975. A good relation exists between daily suspended-sediment discharge and daily mean water discharge except during periods of runoff from glacial melt. Data from samples obtained by the use of the Helley-Smith bedload sampler indicate that the bedload measured using the sampler is about 4 percent of the suspended-sediment discharge. Potential deposition in the reservoir was estimated at 750 acre-feet during the 2 years of study.

INTRODUCTION

The White River originates at the termini of the Emmons and Winthrop Glaciers on the northern flanks of Mount Rainier and transports much sediment during the periods of snowmelt, storm runoff, and glacial melt. Mud Mountain Reservoir is located on the White River near Buckley, Wash. (fig. 1), and operated by the U.S. Corps of Engineers to provide flood protection through controlled release of the runoff. This investigation was undertaken to determine the quantity and particle sizes of the sediment discharged by the river into the reservoir.

DATA COLLECTION

The gaging station on the White River below Clearwater River near Buckley (12097850) provided a continuous stage record during June 1974-June 1976. The station is immediately upstream of the backwater effects from the Mud Mountain Reservoir, about 300 feet upstream of Canyon Creek and about a mile downstream of the Clearwater River.

Water samples were obtained for determination of suspended-sediment concentration once a week during low flows, twice weekly during medium flows, and three times weekly during high flows. The daily record of suspended-sediment discharge (table 1, p.14) was computed from the sample concentrations and water-discharge data collected during the 25 months of the study. Additional water samples were collected to determine the variations in the particle-size distribution of the suspended sediment.

Data on bedload were obtained using a Helley-Smith bedload sampler which entraps sediment moving within 3 inches of the streambed (Helley and Smith, 1971). The sampler was lowered to the bed at 3 or 10 verticals across the channel during each measurement, for 1 minute at each vertical. This entrapped sediment was analyzed for particle size and weighed to estimate the sediment moving in the 3-inch zone. However, during the high flows of December 1-4, 1975, high velocities and turbulence prevented the lowering of the sampler onto the streambed.

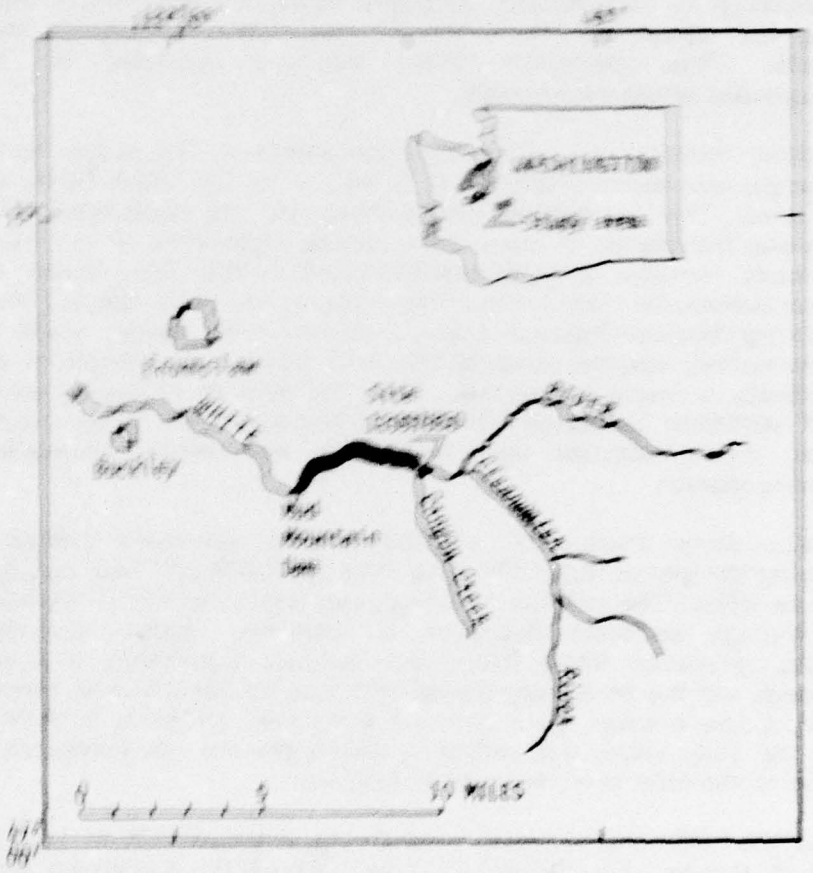

FIGURE 1.—Sketch showing location of station 12097850 (White River below Clearwater River, near Buckley), the data-collection site for the study.

SUSPENDED-SEDIMENT TRANSPORT

Generally, suspended-sediment concentration increases rapidly as water discharge increases, reaches a peak about the same time that the water discharge peaks, and then decreases rapidly even though the water discharge may remain fairly high. Thus, the suspended-sediment concentration at the White River station is expected to change as water discharge changes, but the relation of concentration to water discharge is considerably different during a rising stage than during a falling stage and varies with the origin of runoff (that is, rainfall, snowmelt, or glacial melt). This prompted three separate analyses of the water discharge-suspended sediment relation.

Logarithmic relations of daily suspended-sediment discharges to daily mean water discharges are shown in figures 2, 3, and 4 for the three types of runoff in the White River. The correlation coefficients for the equations (shown on the figures) indicate the degree of association among logarithms of the variables used in the equations. A value of $\pm$1.00 would indicate perfect correlation, and a value of 0.00 would indicate no correlation. The relations shown in figure 2 for periods of storm (occurring October-February), and in figure 3 for spring runoff (May-July), are highly correlated, and the relations shown in figure 4 for periods of glacial melt (July-September), is poorly correlated. Thus, for periods of glacial melt only poor estimates of sediment discharge were found possible from water-discharge data. Even so, all three relations were helpful in determining suspended-sediment transport at the station.

The White River transported 430,000 tons of suspended sediment into the reservoir during the period July 1974-June 1975 and 1,400,000 tons during the period July 1975-June 1976. The relation of these short-term sediment discharges to the long-term average sediment discharge is unknown. Water discharge at the long-term gaging station White River near Buckley (12098500), downstream from the study reach and the reservoir, during 1975 was 104 percent and during 1976 was 124 percent of the average flow during the 43-year (1929-33, 1939-76) period of record, but the daily water and sediment discharges are not comparable to those upstream due to the effects of reservoir regulation.

Much of the sediment is transported during short periods of high streamflow resulting from storms. For example, 55 percent of the suspended sediment was transported into the reservoir during only 7 days of the 760-day period of record. Although the highest daily mean concentration was 6,200 mg/L (milligrams per liter) on December 1, 1975, the daily mean concentrations generally were less than 500 mg/L.

The daily suspended-sediment data collected during the study (table 1) have been published by the U.S. Geological Survey (1976 and 1977, respectively). Several errors that are present in the 1976 report are corrected in table 1. It should be noted that the estimated sediment discharges given in table 1 were calculated by computer to more significant figures than are sometimes meaningful and should be used to only three significant figures above 1,000, only two significant figures between 100 and 1,000, and only one significant figure below 100 tons per day.

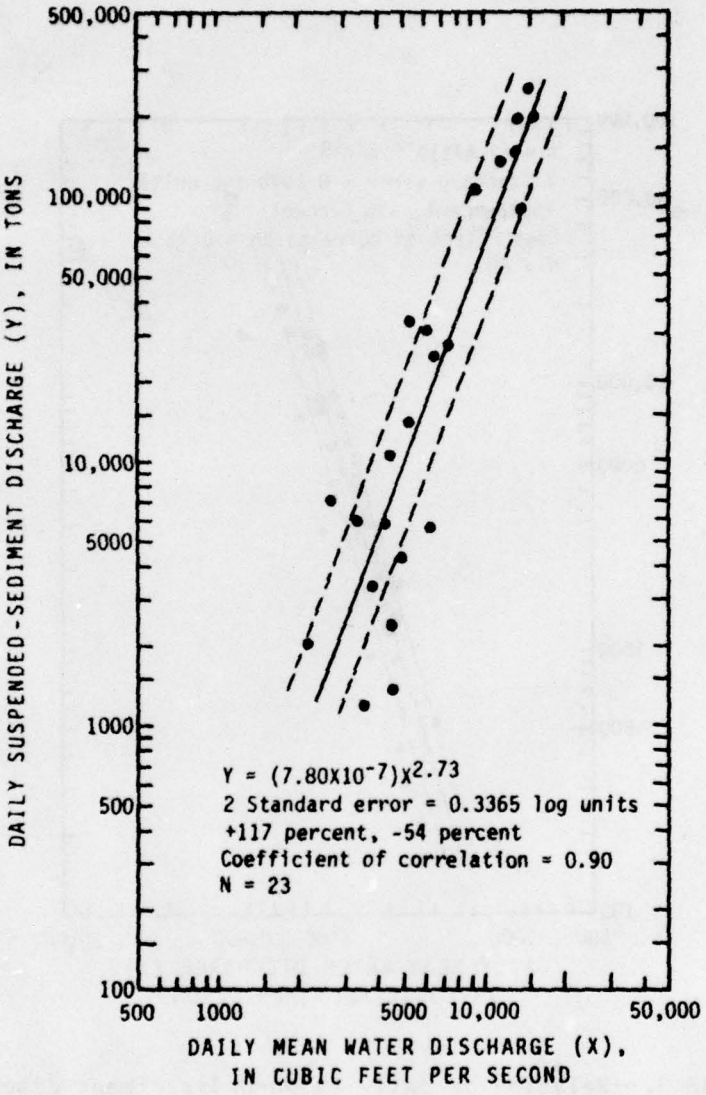

FIGURE 2.—Relation of daily suspended-sediment discharge to daily mean water discharge during selected storms in 1975 and 1976 at station 12097850 (White River below Clearwater River, near Buckley).

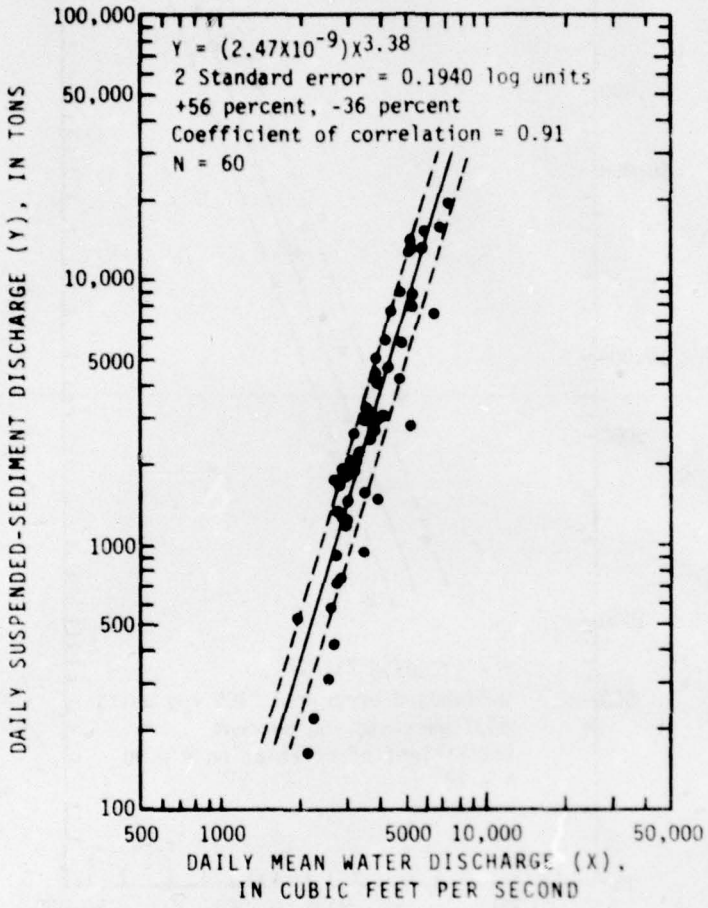

FIGURE 3.—Relation of daily suspended-sediment discharge to daily mean water discharge during periods of spring runoff (June 1974 and 1975) at station 12097850 (White River below Clearwater River, near Buckley).

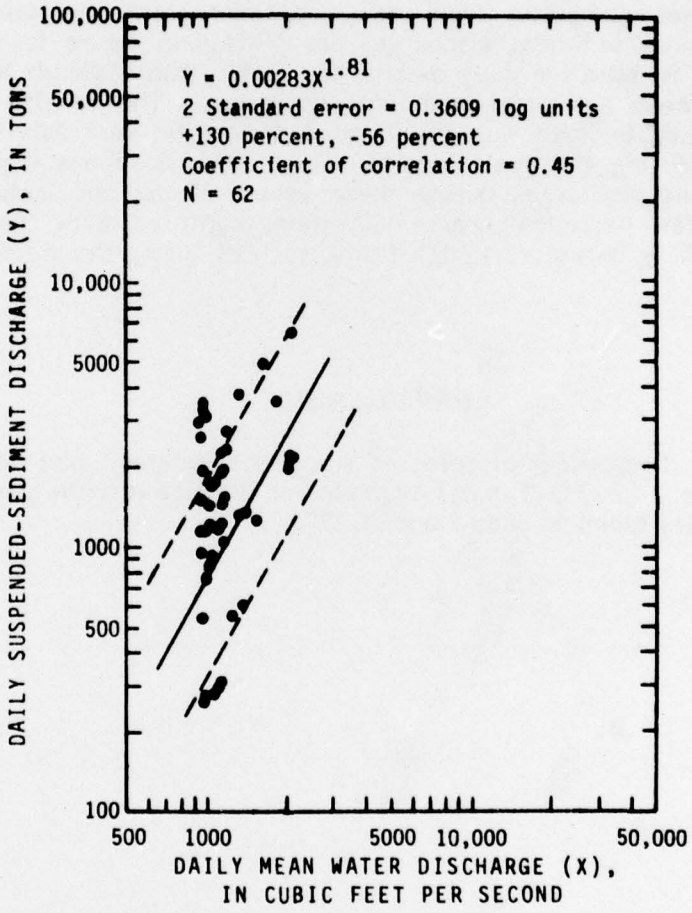

FIGURE 4.—Relation of daily suspended-sediment discharge to daily mean water discharge during periods of glacial melt (August 1974 and 1975) at station 12097850 (White River below Clearwater River, near Buckley).

BEDLOAD

As requested by the U.S. Army Corps of Engineers, the bedload, which is the sediment moving along the bed, was sampled with a Helley-Smith sampler. However, the relation of the actual bedload in the stream to the bedload measured using that sampler has not been evaluated.

The discharges computed from data obtained from the sampler and the concurrent suspended-sediment discharges are plotted in figure 5. Assuming that this relation also is valid for daily means, the daily mean bedloads were estimated from the daily mean suspended-sediment discharges. The results are shown in figure 6. Estimated bedload was 20,000 tons during the year July 1974-June 1975 and 50,000 tons during the year July 1975-June 1976, or about 4 percent of the suspended-sediment discharges during these years. Visual and audio observations indicate that a few particles larger than those captured with the Helley-Smith sampler were moving during very high flows, such as during the storm of December 1-4, 1975.

PARTICLE SIZE

Particle-size distribution of selected suspended-sediment and bedload samples are listed in table 2 (p. 23). Typical examples of the size distributions are shown in figure 7 for samples taken on June 2 and 13, 1975.

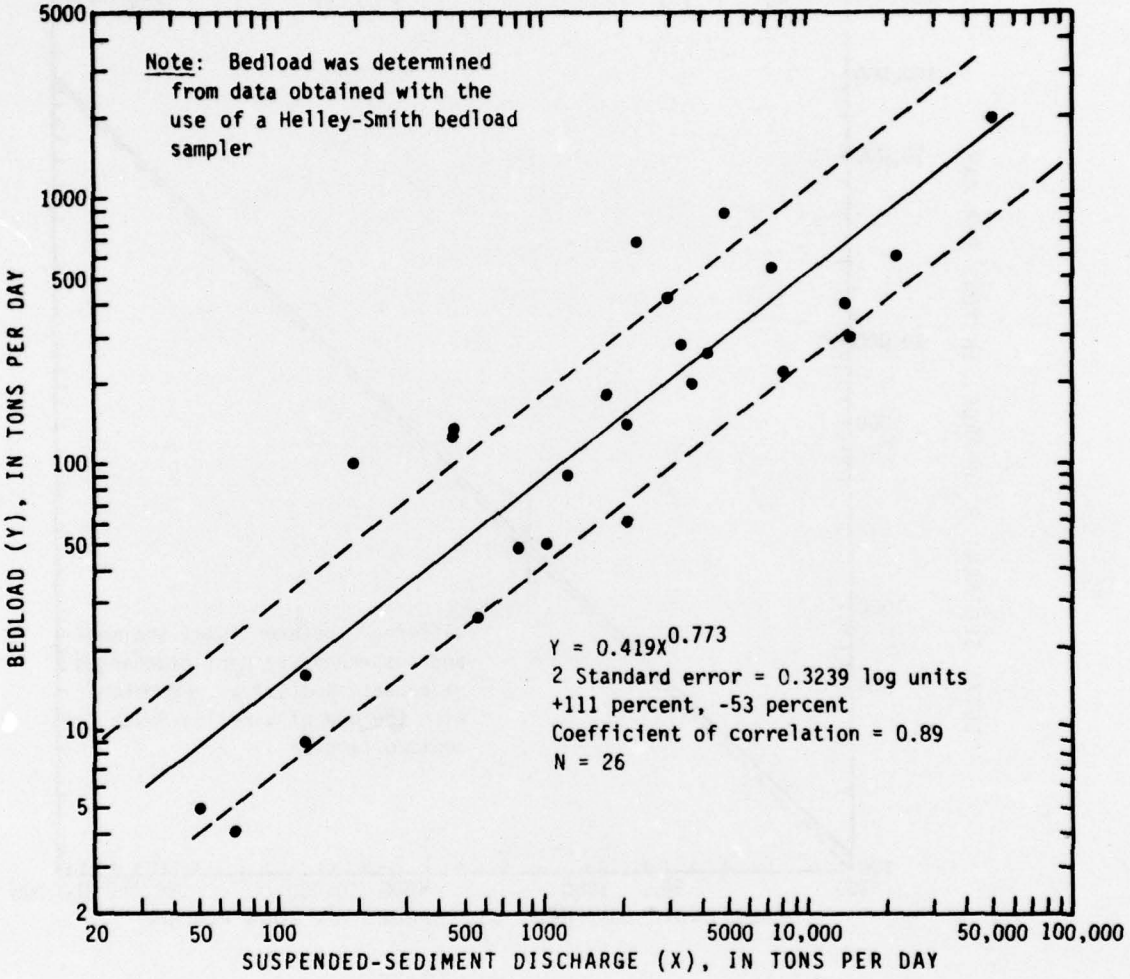

FIGURE 5.—Relation of suspended-sediment discharge to bedload during 1974-76 at station 12097850 (White River below Clearwater River, near Buckley).

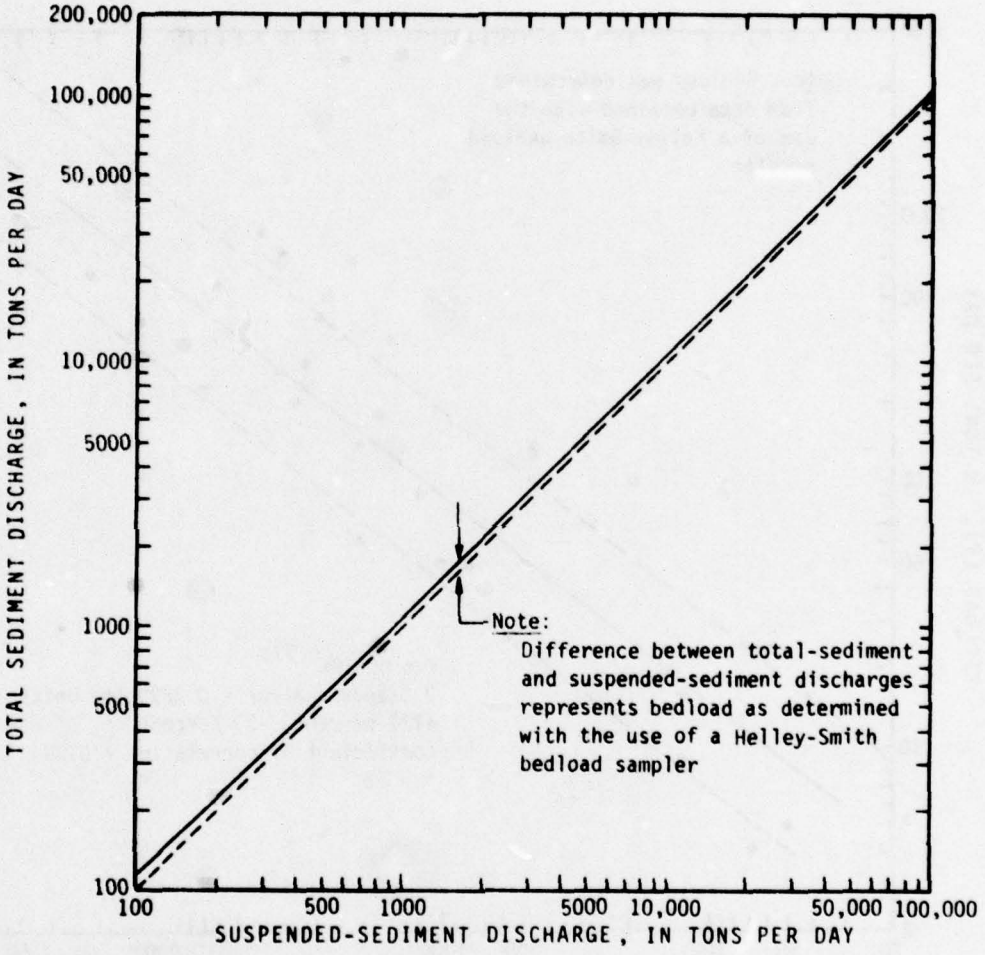

FIGURE 6.—Relation of total-sediment discharge to suspended-sediment discharge at station 12097850 (White River below Clearwater River, near Buckley).

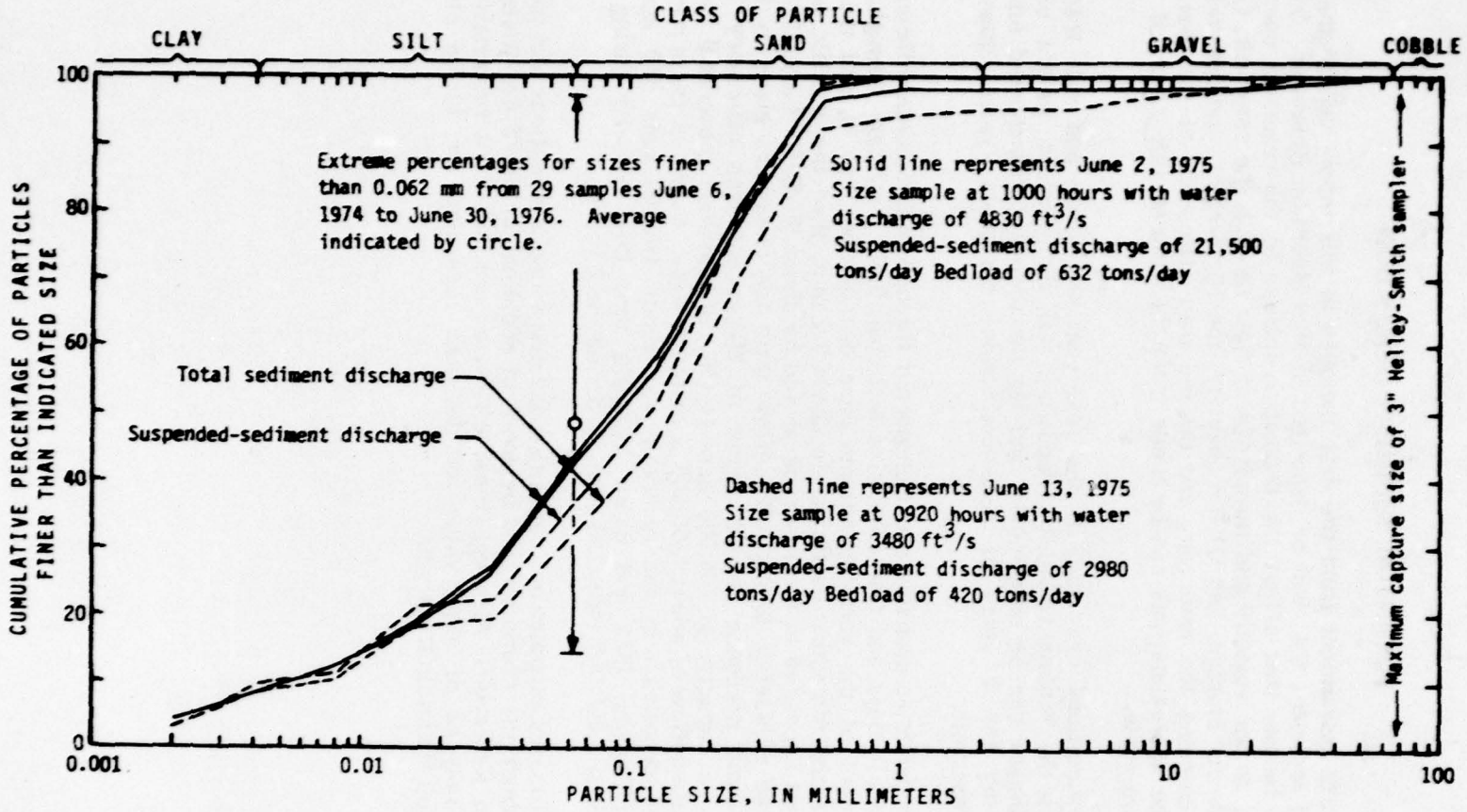

FIGURE 7.—Particle-size distribution of sediment in transport June 2 and 13, 1975, at station 12097850 (White River below Clearwater River, near Buckley).

POTENTIAL SEDIMENT DEPOSITION

No accurate assessment from the data included in this report can be made of the volume of sediment that will be deposited in Mud Mountain Reservoir. Several undetermined factors that affect the deposition include (1) the reservoir operation and its effect on the velocity and turbulence of flow through the reservoir, (2) the space available for storage, and (3) the quantity, specific weight, and fall velocity of sediment entering the reservoir, and (4) the trap efficiency of the reservoir. However, some approximations can be made from the data in this report if some assumptions are made.

These assumptions are that (1) the reservoir has space and will trap the sediments, (2) the sediment will be deposited, (3) the specific weight of the deposited sediment can be determined, and (4) the sediment transported into the reservoir during the 2 years of data collection represents typical quantities entering the reservoir.

The finer particles probably are transported through Mud Mountain Reservoir. Assuming that all clays and fine silts (size less than 0.016 mm) pass through, that about 80 percent of the particles remain (size distribution, fig. 7), and that the median size of the remaining particles are about 0.2 mm, then the specific weight of the sediment deposited in the reservoir should be about 90 lb/ft^3 (Guy, 1970). A relation of trap efficiency to capacity-inflow ratio for reservoirs given by Brune (1953) lends some credence to the figure of 80-percent trap efficiency for a reservoir with a capacity of 106,000 acre-ft (56,000 maximum observed) and an average annual outflow of about 1,100,000 acre-ft per year. Based on those numbers the calculated deposition in the reservoir was about 340,000 tons (180 acre-ft) during July 1974-June 1975 and about 1,100,000 tons (570 acre-ft) during July 1975-June 1976, or 1,440,000 tons (750 acre-ft) during the 2 years.

These estimates of potential deposition involve crude assumptions and meager information about the character and behavior of sediment in the White River and Mud Mountain Reservoir. Although these estimates are only of a reconnaissance nature, they may be of some value for decisions regarding the future storage capacity of Mud Mountain Reservoir.

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Guy, H. P., 1970, Fluvial sediment concepts: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. C1, 55 p.

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-----1977, Water resources data for Washington, water year 1976: U.S. Geological Survey Water Data Report WA-76-1, 403 p.

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1							1960	100	529
2							2790	178	1340
3							3670	316	3130
4							5260	562	7980
5							7280	1000	19700
6							6320	454	7750
7							5140	206	2860
8							3840	145	1500
9							3460	102	953
10							3500	168	1590
11							4100	276	3060
12							4800	453	5870
13							5350	617	8910
14							5790	839	13100
15							6610	895	16000
16							5980	956	15400
17							5110	1020	14100
18							5070	979	13400
19							5140	940	13000
20							4700	781	9910
21							4380	649	7680
22							4180	530	5980
23							3840	432	4480
24							3540	353	3370
25							3330	254	2280
26							3000	183	1480
27							2710	124	907
28							2560	84	581
29							2980	164	1320
30							3120	319	2690
31							---	---	---
TOTAL							129510	---	190850

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	3480	436	4100	2130	383	2200	980	233	617
2	3000	283	2290	2030	383	2100	928	233	584
3	2780	184	1380	2090	383	2160	873	233	549
4	2890	159	1240	2160	383	2230	880	233	554
5	2910	137	1080	2110	1130	6440	850	233	535
6	2680	137	991	1820	715	3510	800	233	503
7	2560	137	947	1550	300	1260	770	233	484
8	2560	137	947	1380	162	604	759	233	477
9	2700	137	999	1320	162	577	844	233	531
10	2560	137	947	1340	162	586	925	233	582
11	2410	137	891	1380	162	604	807	233	508
12	2220	137	821	1270	162	555	682	233	429
13	2090	137	773	1150	100	311	628	233	395
14	2240	137	829	1070	100	289	604	233	380
15	2480	137	917	1040	100	281	606	233	381
16	2280	137	843	1040	100	281	596	114	183
17	2490	137	921	1050	100	284	591	114	182
18	2880	580	4510	1110	100	300	590	114	182
19	2980	580	4670	1060	100	286	603	114	186
20	2710	580	4240	980	100	265	616	114	190
21	2470	580	3870	950	100	257	625	114	192
22	2450	580	3840	955	100	258	619	114	191
23	2310	172	1070	960	100	259	609	114	187
24	2240	172	1040	960	100	259	602	114	185
25	2180	172	1010	955	100	258	599	114	184
26	2130	172	989	959	100	259	585	114	180
27	2160	172	1000	955	100	258	524	114	161
28	2230	552	3320	999	100	270	507	114	156
29	2370	552	3530	1040	610	1710	497	114	153
30	2390	552	3560	1060	610	1750	484	114	149
31	2280	552	3400	1030	610	1700	---	---	---
TOTAL	78110	---	60965	39903	---	32361	20583	---	10170

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		OCTOBER			NOVEMBER			DECEMBER	
1	482	36	47	388	13	14	527	27	38
2	541	37	54	354	14	13	527	29	41
3	500	37	50	300	15	12	506	31	42
4	474	36	46	275	15	11	574	33	51
5	441	33	39	270	16	12	541	39	57
6	421	30	34	354	17	16	547	44	65
7	408	27	30	549	17	25	590	51	81
8	406	25	27	440	18	21	540	59	86
9	411	22	24	420	19	22	549	68	101
10	411	22	24	456	20	25	558	78	118
11	408	22	24	400	21	23	783	90	190
12	397	22	24	426	22	25	745	91	183
13	387	22	23	483	22	29	696	91	171
14	378	22	22	420	23	26	674	91	166
15	374	22	22	390	23	24	880	90	214
16	381	21	22	360	23	22	1510	106	432
17	384	21	22	402	22	24	1670	125	564
18	380	20	21	623	49	82	1360	146	536
19	379	19	19	646	107	187	1400	180	680
20	419	18	20	728	235	462	5420	2300	33700
21	388	18	19	1720	950	4410	6580	1400	24900
22	360	17	17	1120	610	1840	3360	550	4990
23	342	16	15	1190	391	1260	2150	260	1510
24	342	16	15	1670	251	1130	1590	150	644
25	336	16	15	1280	161	556	1320	80	285
26	330	15	13	968	103	269	1230	40	133
27	330	15	13	794	66	141	1540	41	170
28	360	15	15	674	41	75	1230	41	136
29	425	14	16	606	25	41	1100	41	122
30	366	14	14	561	25	38	1140	41	126
31	378	13	13	---	---	---	954	40	103
TOTAL	12339	---	759	19267	---	10835	42791	---	70635

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JANUARY			FEBRUARY			MARCH	
1	907	40	98	1170	4	13	2640	2	14
2	820	38	84	1080	5	15	3290	3	27
3	803	35	76	1020	5	14	3210	3	26
4	861	33	77	960	5	13	2530	3	20
5	1200	31	100	900	5	12	2030	3	16
6	1380	29	108	870	5	12	1690	3	14
7	1090	27	79	1000	5	13	1450	3	12
8	1090	25	74	910	5	12	1380	3	11
9	925	23	57	920	5	12	1340	3	11
10	825	22	49	950	5	13	1240	3	10
11	729	20	39	930	4	10	1150	3	9.3
12	1690	110	502	1560	45	190	1100	3	8.9
13	3000	100	810	2380	32	206	1040	3	8.4
14	3110	67	563	1710	23	106	980	3	7.9
15	2210	45	269	1380	16	60	960	3	7.8
16	1750	30	142	1230	12	40	960	3	7.8
17	6200	1810	30300	1080	8	23	970	3	7.9
18	13800	2390	89100	1010	6	16	1040	3	8.4
19	5280	980	14000	1140	4	12	1010	3	8.2
20	3780	340	3470	1230	4	13	930	3	7.5
21	3190	70	603	1040	4	11	890	3	7.2
22	2640	55	392	980	4	11	851	3	6.9
23	3690	43	428	1000	3	8.1	842	3	6.8
24	3950	34	363	1560	3	13	797	3	6.5
25	3360	27	245	1400	3	11	761	3	6.2
26	2720	21	154	1280	3	10	752	3	6.1
27	2150	17	99	1200	3	9.7	698	3	5.7
28	1820	13	64	1810	2	9.8	680	3	5.5
29	1520	10	41	---	---	---	680	3	5.5
30	1360	6	29	---	---	---	788	3	6.4
31	1260	6	20	---	---	---	770	2	4.2
TOTAL	79110	---	142435	33700	---	888.6	39449	---	310.1

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1	716	5	9.7	1150	8	25	3990	420	4520
2	734	6	12	1390	10	38	4740	1120	14300
3	689	6	11	1520	11	45	4290	490	5680
4	680	6	11	1460	13	51	3860	440	4590
5	648	6	10	1340	14	51	3950	400	4270
6	640	6	10	1300	16	56	3960	402	4190
7	648	6	10	1290	19	66	3550	327	3130
8	648	6	10	1380	21	78	3040	252	2070
9	680	6	11	1880	24	122	2770	177	1320
10	698	6	11	3040	39	320	2770	102	763
11	752	6	12	3950	62	661	2960	149	1190
12	890	6	14	3460	98	916	3250	218	1910
13	1010	6	16	3330	114	1020	3480	317	2980
14	950	6	15	3880	132	1380	3670	294	2910
15	890	6	14	3900	153	1610	3820	272	2810
16	900	6	15	3610	176	1720	3670	252	2500
17	890	6	14	3480	148	1390	3250	233	2040
18	920	6	15	3550	124	1190	2830	231	1770
19	1060	6	17	3440	104	966	2760	229	1710
20	1030	6	17	3020	83	677	2960	227	1810
21	990	6	16	2760	67	499	3140	233	1980
22	1020	6	17	2620	53	375	2980	239	1920
23	1060	6	17	2640	42	299	2680	245	1770
24	1090	6	18	3000	35	283	2910	250	1960
25	1200	6	19	2740	29	215	3000	154	1250
26	1140	6	18	2620	25	177	2850	95	731
27	1170	6	19	2620	20	141	2700	58	423
28	1070	6	17	2640	39	278	2530	46	314
29	1000	6	16	2680	73	528	2280	36	222
30	1030	5	14	2930	100	791	2130	28	161
31	---	---	---	3630	320	3140	---	---	---
TOTAL	26843	---	425.7	82250	---	19108	96670	---	77194

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JULY			AUGUST			SEPTEMBER	
1	2170	60	352	1170	332	1050	880	94	223
2	2300	91	565	1170	456	1440	815	90	198
3	2570	161	1120	1170	626	1980	770	86	179
4	2950	283	2250	1180	859	2740	725	82	161
5	3570	497	4790	1200	726	2350	734	78	155
6	3910	875	9240	1160	614	1920	752	108	219
7	3840	1540	16000	1090	519	1530	797	149	321
8	3760	1690	17200	1050	438	1240	788	205	436
9	3760	1860	18900	1020	440	1210	734	208	412
10	3760	2010	20400	980	442	1170	734	210	416
11	3740	2180	22000	960	443	1150	730	213	420
12	3480	1600	15000	950	583	1500	730	215	424
13	2950	1170	9320	950	765	1960	740	257	513
14	2580	854	5950	950	1010	2590	760	307	630
15	2340	638	4030	970	1320	3460	800	366	791
16	2190	477	2820	970	1250	3270	800	436	942
17	2050	357	1980	930	1180	2960	770	345	717
18	1810	266	1300	1630	1120	4930	700	273	516
19	1630	278	1220	1320	1060	3780	620	215	360
20	1620	290	1270	1130	749	2290	600	170	275
21	1670	302	1360	1010	529	1440	580	135	211
22	1630	315	1390	940	373	947	590	106	169
23	1600	412	1780	1330	367	1320	600	107	173
24	1620	537	2350	1400	360	1360	590	107	170
25	1630	700	3080	1140	353	1090	570	107	165
26	1620	870	3810	1040	333	935	550	107	159
27	1690	1080	4930	1010	314	856	540	107	156
28	1690	1340	6110	1000	296	799	540	107	156
29	1500	842	3410	990	278	743	510	107	147
30	1360	529	1940	960	208	539	490	107	142
31	1250	332	1120	990	155	414	---	---	---
TOTAL	74240	---	186987	33760	---	54963	20539	---	9956

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		OCTOBER			NOVEMBER			DECEMBER	
1	500	110	148	1650	511	2280	15000	6200	251000
2	600	112	181	1770	416	1990	15600	4680	197000
3	650	102	179	2070	339	1890	13600	5310	195000
4	700	93	176	1820	276	1360	13100	4100	145000
5	600	85	138	1630	225	990	7230	1400	27300
6	580	78	122	1550	183	766	4430	870	10400
7	504	71	97	1400	137	518	4240	510	5840
8	456	65	80	1250	102	344	4940	321	4280
9	512	59	82	1100	77	229	4460	202	2430
10	552	52	78	1000	57	154	3510	127	1200
11	472	46	59	950	43	110	2780	80	600
12	440	41	49	900	32	78	2280	51	314
13	419	36	41	900	24	58	1960	32	169
14	419	32	36	1500	27	109	1690	25	114
15	600	28	45	3000	30	243	1660	20	90
16	520	25	35	2500	33	223	1480	16	64
17	584	55	87	2000	37	200	1350	13	47
18	860	119	276	1600	41	177	1290	10	35
19	1210	259	846	1300	45	158	1200	12	39
20	1220	566	1860	1100	50	148	1130	14	43
21	1100	339	1010	1000	100	270	1060	16	46
22	1010	203	554	950	201	516	1050	19	54
23	950	122	313	1600	404	1750	1120	22	67
24	860	159	369	2800	812	6140	1590	26	112
25	1170	207	654	2480	510	3410	1670	27	122
26	1460	269	1060	3320	320	2870	3280	29	257
27	1140	350	1080	2780	201	1510	3320	30	269
28	1060	455	1300	2160	205	1200	2440	32	211
29	1650	592	2640	1730	210	981	2820	33	251
30	2340	770	4860	2610	1000	7050	3170	35	300
31	1850	627	3130	---	---	---	2480	37	248
TOTAL	26988	---	21585	52420	---	37727	126930	---	842902

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		JANUARY			FEBRUARY			MARCH	
1	1980	33	176	1730	9	42	806	4	8.7
2	1700	30	138	1650	8	36	779	3	6.3
3	1550	26	109	1560	8	34	761	3	6.2
4	2190	24	142	1450	7	27	734	2	4.0
5	2560	21	145	1300	7	25	698	2	3.8
6	1990	19	102	1260	7	24	698	2	3.8
7	1720	17	79	1210	7	23	698	2	3.8
8	1910	15	77	1150	7	22	689	2	3.7
9	1720	16	74	1100	7	21	716	1	1.9
10	1550	17	71	1040	7	20	797	1	2.2
11	1740	17	80	1060	7	20	806	1	2.2
12	1520	18	74	1300	7	25	743	1	2.0
13	1330	19	68	1160	6	19	734	1	2.0
14	2340	20	126	1090	5	15	725	1	2.0
15	9380	4140	105000	1050	5	14	698	1	1.9
16	11800	4170	133000	1330	4	14	716	1	1.9
17	6250	330	5570	1420	3	12	815	2	4.4
18	4600	110	1370	1460	3	12	1000	2	5.4
19	3610	82	799	1290	3	10	1010	2	5.5
20	2900	61	478	1150	2	6.2	940	3	7.6
21	2410	46	299	1070	2	5.9	870	3	7.0
22	2210	34	203	1020	3	8.3	930	4	10
23	2010	25	136	1020	3	8.3	950	4	10
24	1790	18	87	1010	4	11	1100	3	8.9
25	1650	14	62	1010	5	14	1090	3	8.8
26	1530	10	41	950	6	15	1010	3	8.2
27	2880	10	78	930	8	20	960	3	7.8
28	2680	10	72	910	6	15	930	3	7.5
29	2320	9	56	851	5	11	870	2	4.7
30	2040	9	50	---	---	---	860	2	4.6
31	1830	9	44	---	---	---	1020	2	5.5
TOTAL	87690	---	248806	34531	---	529.6	26153	---	162.3

TABLE 1.--Daily suspended-sediment data for White River below Clearwater River, near Buckley (station 12097850), June 1, 1974-June 30, 1976--Continued

DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
		APRIL			MAY			JUNE	
1	950	3	7.7	2170	5	29	1400	3	11
2	870	4	9.4	3140	7	59	1330	2	7.2
3	851	6	14	2820	9	69	1230	2	6.6
4	930	9	23	2500	12	81	1160	3	9.4
5	1130	14	43	2300	16	99	1110	3	9.0
6	1550	20	84	2090	13	73	1110	4	12
7	1520	16	66	2120	11	63	1130	4	12
8	1990	13	70	2580	15	104	1270	5	17
9	2070	11	61	3190	19	164	1410	6	23
10	1860	9	45	3660	25	247	1580	7	30
11	2170	7	41	3340	33	298	1620	8	35
12	1980	6	32	2800	44	333	1590	10	43
13	1720	5	23	2820	41	312	1560	8	34
14	1530	4	17	2880	38	295	1440	7	27
15	1450	3	12	2580	36	251	1500	6	24
16	1280	2	6.9	2520	28	191	2280	11	68
17	1170	2	6.3	2640	22	157	2540	22	151
18	1120	2	6.0	2280	17	105	2740	42	311
19	1070	2	5.8	2040	13	72	2990	80	646
20	1380	2	7.5	1820	13	64	2900	57	446
21	1320	2	7.1	1690	12	55	2640	40	285
22	1230	2	6.6	1700	12	55	2340	28	177
23	1130	2	6.1	1720	10	46	2020	20	109
24	1280	2	6.9	1670	8	36	1930	17	89
25	1290	2	7.0	1690	6	27	1830	15	74
26	1180	2	6.4	1590	5	21	1660	13	58
27	1150	2	6.2	1900	6	31	1630	18	79
28	1180	2	6.4	1930	8	42	1790	25	121
29	1280	3	10	1770	10	48	2140	34	196
30	1590	4	17	1650	7	31	2090	47	265
31	---	---	---	1500	4	16	---	---	---
TOTAL	41221	---	660.3	71100	---	3474	53960	---	3375.2

TABLE 2.--Particle-size data for White River below Clearwater River, near Buckley, station 12097850

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SEDIMENT DISCH. SUSP. + BED MATERIAL (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM
JUN . 1974									
06...	1440	8.4	5960	397	6390	6940	--	--	--
10...	1250	9.2	3740	102	1030	1080	--	--	--
14...	1240	8.0	6160	839	14000	14400	--	--	--
17...	1320	9.0	5270	1020	14500	14800	--	--	--
21...	1140	9.0	4640	649	8130	8350	--	--	--
24...	1255	9.0	3790	353	3610	3810	--	--	--
28...	1230	9.4	2530	84	574	600	--	--	--
JUL									
01...	1300	7.4	3610	436	4250	4510	--	--	--
05...	1310	9.0	2930	158	1250	1340	--	--	--
08...	1020	8.4	2580	115	801	849	--	--	--
22...	0950	8.4	2510	307	2080	2140	--	--	--
29...	1010	9.6	2410	519	3380	3660	--	--	--
AUG									
02...	1300	11.5	2010	383	2080	2220	--	--	--
07...	1255	9.4	1540	300	125	141	--	--	--
09...	1145	10.0	1300	131	460	594	--	--	--
23...	1150	11.0	1000	71	192	292	--	--	--
SEP									
11...	1245	10.3	844	199	453	580	--	--	--
18...	1235	11.0	577	81	126	137	--	--	--
NOV									
21...	1120	4.4	1900	950	4870	5750	--	--	--
DEC									
04...	0925	5.0	595	33	53	193	--	--	--
JAN . 1975									
17...	1300	--	7400	2500	50000	52000	--	--	--
MAY									
16...	1330	8.1	3590	176	1710	1890	--	--	--
JUN									
02...	1000	7.4	4830	1650	21500	22100	4	8	12
13...	0920	7.4	3480	317	2980	3400	3	9	11
DEC									
05...	0950	5.2	7960	1360	29200	--	5	8	12
09...	1540	3.5	4240	202	2280	2960	--	--	--
JAN . 1976									
26...	1140	3.3	1520	10	41	46	--	--	--
APR									
21...	1530	6.8	1280	2	7.5	--	--	--	--
MAY									
07...	0950	6.4	2120	11	66	70	--	--	--

TABLE 2.--Particle-size data for White River below Clearwater River, near Buckley, station 12097850--Continued

DATE	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	SED. SUSP. FALL DIAM. % FINER THAN .125 MM	SED. SUSP. FALL DIAM. % FINER THAN .250 MM	SED. SUSP. FALL DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM
JUN • 1974									
06...	--	--	--	--	--	--	<1	5	28
10...	--	--	41	59	90	100	<1	6	61
14...	--	--	40	57	84	98	15	62	74
17...	--	--	45	67	90	99	1	18	57
21...	--	--	44	60	88	100	1	6	71
24...	--	--	42	62	86	100	<1	4	39
28...	--	--	40	58	87	100	<1	15	85
JUL									
01...	--	--	44	60	89	100	<1	14	48
05...	--	--	41	54	87	100	<1	14	72
08...	--	--	44	63	94	100	<1	10	80
22...	--	--	63	--	--	--	<1	21	91
29...	--	--	69	--	--	--	<1	11	84
AUG									
02...	--	--	66	--	--	--	1	18	93
07...	--	--	48	--	--	--	<1	10	93
09...	--	--	49	--	--	--	1	20	93
23...	--	--	--	--	--	--	<1	7	81
SEP									
11...	--	--	--	--	--	--	<1	8	73
18...	--	--	--	--	--	--	<1	15	76
NOV									
21...	--	--	--	--	--	--	1	27	74
DEC									
04...	--	--	--	--	--	--	<1	14	76
JAN • 1975									
17...	--	--	27	43	76	98	1	10	40
MAY									
16...	--	--	14	38	75	97	<1	3	18
JUN									
02...	19	27	43	58	80	98	1	7	29
13...	21	22	36	51	79	99	1	9	42
DEC									
05...	18	25	38	56	85	98	--	--	--
09...	--	--	29	--	--	--	<1	3	14
JAN • 1976									
26...	--	--	--	--	--	--	1	17	71
APR									
21...	--	--	59	--	--	--	--	--	--
MAY									
07...	--	--	49	--	--	--	1	15	81

TABLE 2.--Particle-size data for White River below Clearwater River, near Buckley, station 12097850--Continued

DATE	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM	STREAM WIDTH (FT)	NUMBER OF SAMPLING POINTS
JUN , 1974								
06...	48	55	60	64	71	80	152	10
10...	78	85	90	94	98	100	148	10
14...	76	76	77	77	79	88	150	10
17...	64	65	65	66	67	74	151	10
21...	87	90	92	95	97	98	150	10
24...	58	58	58	58	58	--	149	10
28...	98	100	100	--	--	--	147	10
JUL								
01...	54	55	56	56	58	62	149	10
05...	84	88	90	92	93	100	147	10
08...	92	95	97	98	100	--	147	10
22...	99	100	100	--	--	--	147	10
29...	97	98	99	99	100	--	147	3
AUG								
02...	100	100	--	--	--	--	147	3
07...	100	100	--	--	--	--	146	3
09...	92	100	--	--	--	--	146	3
23...	100	100	--	--	--	--	145	3
SEP								
11...	100	100	--	--	--	--	143	3
18...	100	100	100	--	--	--	138	3
NOV								
21...	100	100	--	--	--	--	147	3
DEC								
04...	99	100	--	--	--	--	138	3
JAN , 1975								
17...	49	51	52	53	57	76	156	3
MAY								
16...	24	25	26	26	26	35	148	10
JUN								
02...	39	41	42	42	46	68	150	10
13...	54	57	63	74	87	100	146	3
DEC								
05...	--	--	--	--	--	--	156	3
09...	17	18	19	24	34	73	150	3
JAN , 1976								
26...	93	97	100	--	--	--	144	3
APR								
21...	--	--	--	--	--	--	--	--
MAY								
07...	97	99	100	--	--	--	145	10

TABLE 2.--Particle-size data for White River below Clearwater River, near Buckley, station 12097850--Continued

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW (CFS)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT DISCHARGE, SUSPENDED (T/DAY)	SEDIMENT DISCH. SUSP. + BED MATERIAL (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM
MAY , 1976									
15...	0715	5.2	2660	36	272	298	42	<1	8
22...	0650	8.3	1740	12	64	64	97	0	15
29...	0705	5.0	1790	10	54	55	20	0	10
JUN									
05...	0720	5.6	1130	3	11	11	79	0	9
12...	0640	6.7	2520	10	75	77	54	0	17
19...	0850	7.8	3060	80	646	770	50	<1	5
30...	0920	8.2	2120	47	276	276	70	<1	16

DATE	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. STEVE DIAM. % FINER THAN 32.0 MM	STREAM WIDTH (FT)	NUMBER OF SAMPLING POINTS
MAY , 1976									
15...	51	71	80	83	86	88	100	146	10
22...	74	93	95	99	100	--	--	144	10
29...	64	93	99	100	--	--	--	144	10
JUN									
05...	68	94	99	100	--	--	--	143	--
12...	81	94	97	100	--	--	--	146	10
19...	37	60	69	73	76	79	86	147	10
30...	75	95	98	99	100	--	--	145	10